

Double Fed Induction Motor and DC Generator

Background:

Doubly fed induction machine is a machine that can be used as a motor or generator depending on how we operate it. Doubly fed induction motor (DFIM) is used because it offers the opportunity to modulate power flow into and out the rotor winding in order to have, at the same time, a variable speed in the characterized super-synchronous or sub-synchronous modes in motor or in generator regimes. The DFIM can be controlled from the stator or rotor by various possible combinations. The primary (stator) is connected to a balanced three phase power supply. A travelling flux is induced in the rotor (primary) that travels along the length of the primary. The travelling wave flux induces a current in the secondary member.

Objectives:

1. Change the resistance in the load bank to change the rotor frequency in the DFIM and the current of armature in the DC motor. We need to see the relationship between rotor frequency and power generated by DC machine.
2. Measuring the power in DFIM and DC machine. The power in DFIM is input power, the power in DC machine is output power. We can find the differences of these power and figure the losses of power. The lower power losses, the higher efficiency of the instrument

Apparatus:

- 1) 2 test tables
- 2) DC Generator
- 3) DC power supply
- 4) DFIM

- 5) Tachometer
- 6) 4 Multimeters
- 7) Single phase load bank
- 8) Three phase load bank

Procedure:

- 1) Connect the first test table to the stator on the DFIM. The other side of the test table should be connected to the distribution panel. Use 240VAC.
- 2) Connect the stator in delta connection on the DFIM as shown in figure 1.
- 3) Apply a three phase resistive load bank to the rotor on the DFIM as shown in figure 1. Make sure you have set the resistive load bank to the maximum impedance.
- 4) Connect the DC power supplier to the field on the DC generator to excite the field.
- 5) Connect the single resistive load bank through the second test table to the armature of the DC generator. Keep the switches on the left side of the table open.
- 6) Connect a multimeter from the second test table to the resistive load bank to measure the output current.
- 7) Once you have finished all the connections, ask your instructor to check them.
- 8) After checking getting approval, energize the DFIM.
- 9) Use the DC power to adjust the field current to 1.2A.
- 10) Start with the highest resistance possible in the load bank connected to the armature of the DC machine, and then decrease it gradually. Refer to the sheet on the back of the load bank to get the highest resistance possible.

11) While you are decreasing the resistance, record the frequency on the rotor, speed, output voltage, and output current.

12) Using tachometer to measure the speed of rotation.

13) Once you have measured the frequency, speed, output voltage, and output current. De-energize the DC generator and slowly power down the DFIM with the power supply.

14) Once the machine set has come to a complete stop, de-energize your station's power and put away your cables.

Data table

Current(DC)	Voltage(DC)	Frequency(rotor)	speed	Power(DC)	Power(DFIM)
0.255	13.94	25.2	1042	3.56	49
0.498	13.55	25.4	1038	6.75	49
2.125	10.15	27	990	21.57	49
2.369	9.48	27.4	980	22.46	49
2.985	7.99	28	960	23.85	49
3.195	7.48	28.2	952	23.9	49
3.750	6.45	28.5	944	24.19	49

Questions:

1. Do we have other ways to change the rotor frequency? And which way?

2. If we change the direction of rotation what the situation of rotor frequency in DFIM?

3.What happens to the speed when we decrease the output resistance? And why?

4..If we increase the resistance on the rotor of the DFIM, what happens to the speed?And why?

Summary:

In this experiment, people can learn how to change the rotor frequency of the DFIM, changing the frequency by changing the resistance of the load in the DC motor. The frequency of stator is always 60HZ. people also can learn how to calculate the power losses.People need to calculate the loss by measuring the output power and the input power. The input power can be measured using the first test table, and add the power of each phase. The output power can be measured by an electric meter in the armature of DC machine. People need to measure the voltage and current for armature then figure it. Power losses is equal to input power subtract output power.

Conclusion:

people need to use the resistance in the load bank to change it then we can change the current in the armature of DC machine. It also can change the frequency in the rotor of DFIM. People found that when we decrease the resistance, the armature current in DC machine increases. The voltage of Armature of the DC machine decreases. The rotor frequency in DFIM increases. More resistance may have more output power, so have less the loss of power. The input power is always a constant number.